

eStar Forward Tracking upgrade

Silicon detector

Design is based on Single sided Double metal AC coupled Silicon Mini Strip (P on N) in 3 size related to installation place in detector, planes are named Z1@70CM , Z2@105CM , Z3@140 CM. Design is based on Single sided Double metal AC coupled Silicon Mini Strip in 3 size related to installation place in detector, Types (sizes) are named Z1@70CM , Z2@105CM , Z3@140 CM . The whole sensor plane is divided to 12 modules. Each module is divided to 8 in R (from $\eta=4$ to 2.5) and 128 in Phi Mini Silicon Strip array (figure 1). Dimensions of and pitches (maximum / minimum/ averages) are in table 2 . For each module 8 APV25 chip is used to readout the sensors.

1 Geometrical specification

1.1 Wafer Dimensions

The sensor modules are in sector shape with total angle of 30.84° . The innermost radius is R_{in} and outer radius is R_{out} .

Parameter	Z1	Z2	Z3
Thickness	$300\mu m \pm 15$	$300\mu m \pm 15$	$300\mu m \pm 15$
Dimensions(max) Length \times Width μm	95000×65000	139100×96200	187100×13000
Dimensions(max) $R_{in} \times R_{out} \mu m$	25650×115698	38475×173547	51300×231397

Table 1: Wafers Dimensions as shown in figure 1

1.2 Active area Dimensions

Parameter	Z1	Z2	Z3
Number of strips (column \times row)	128×8	128×8	128×8
P-Implant width	$40\mu m$	$40\mu m$	$40\mu m$
Metal strip width	$42\mu m$	$42\mu m$	$42\mu m$
Strip pitch (Row1-8)	$473 - 105\mu m$	$709 - 157\mu m$	$946 - 210\mu m$

Table 2: Active area Dimensions. Detailed Pitches and length of strip are in table 4

Pad type	Size	Numbers
AC pad	$80 \times 40\mu m$	1/strip
DC pad	$80 \times 42\mu m$	1/strip
Bonding Pad	$136 \times 56\mu m$	1/strip
Bias Pad	$200 \times 200\mu m$	2/Module

Table 3: Bonding and Probe Pads

1.3 Bonding and Probe Pads

2 Description

Each sensor wafer has 10 mask layer as following (figure 2):

1. Layer 1 for Al layer at back-plane .
2. Layer 2 for N++ Implant at tailplane.
3. Layer 3 for N-Implant.
4. Layer 5 for P-implant .
5. Layer 7 for Poly-Silicon for Bias resistor .
6. Layer 9 for Metal-layer 1 over SiO2 layer.
7. Layer 10 for Metal Via 1 layer 10 to connect P-implant to Poly-Silicon bias resistor .
8. Layer 13 Metal layer 2 for routing to Bonding Pads at edge of wafer.
9. Layer 14 for Metal Via 2 layer to Connect Metal-layer 1 to 2 .
10. Layer 19 for Passive (protection) layer as negative mask.

Poly-Silicon layer resistor would be connected to P-Implant via Metal-Vial and from the other side to Bias ring via direct epitaxial connection (bias ring is in Metal-layer 1) with value of $3M\Omega$ and length of $100\mu m$. The width of Strips are constant $40\mu m$ with AC couple Metal with a overhang length of $2\mu m$ (5% overhang). The Width of strips and overhang metals could change regard to further investigation and simulation to optimize the efficiency of detector as well as number of needed Gurdrings. Also design rule check could varies regard to manufacturer specification.

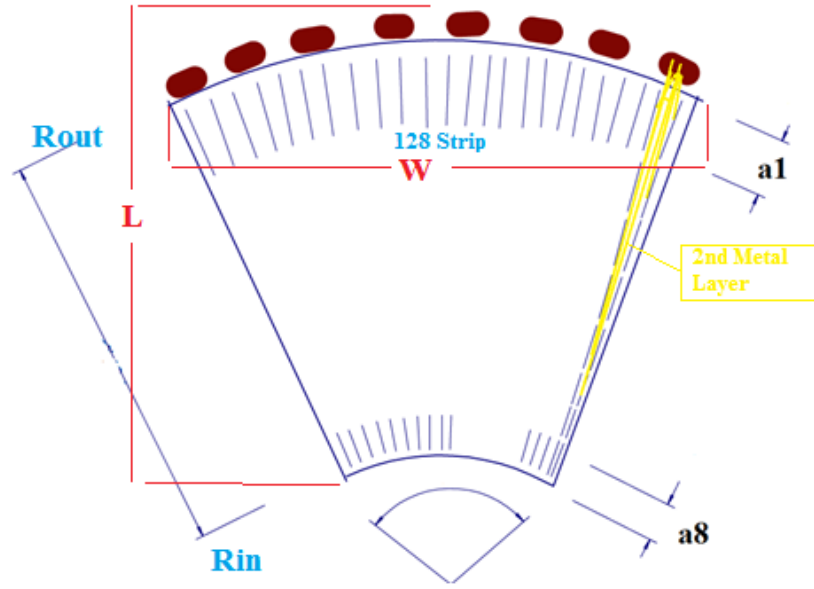


Figure 1: General Schematics of Silicon strip module as a sector with angle of 30.84 and in 3 size for Rin and Rout

Design rules for routing tracks to readout chip and bond pads are as following :

- Track Clearance 10um
- Metal readout track is 10um.
- Between each sensor raw at R plane there is 140um gap to feed the Bias line trough So actual length of Strips are 140um smaller than table 4.
- AC couple metal strip also are shorter about 100um than P-implant strip reserved for Poly-silicon Bias resistor.
- Bias line has track width of 40um and GurdRing 50um

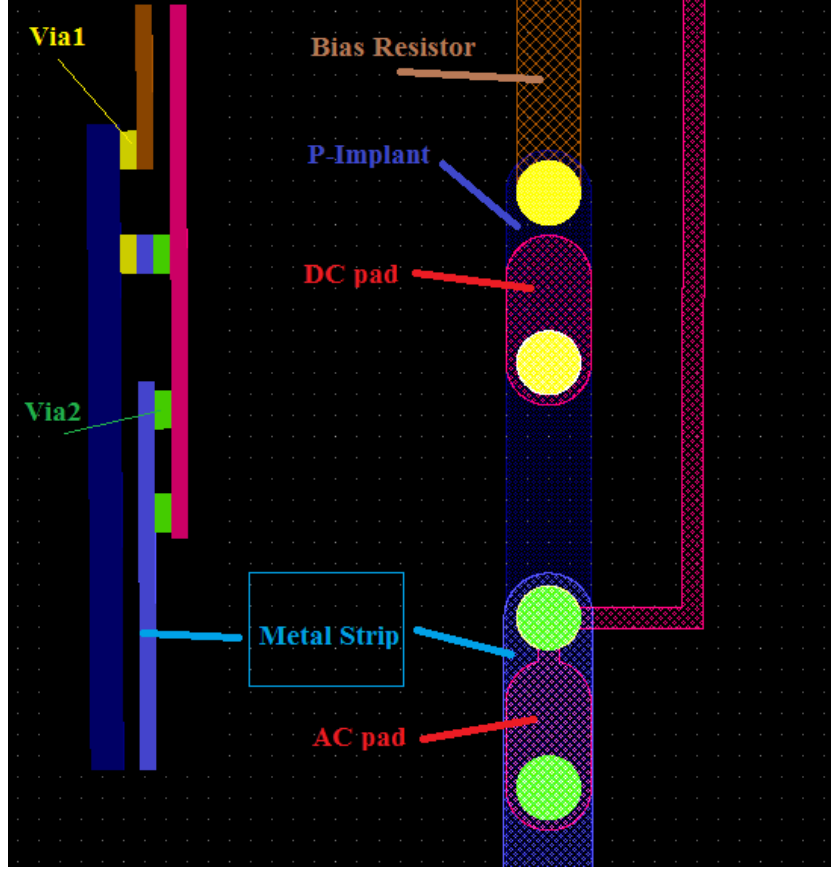


Figure 2: Single Silicon strip layers and cross section

η (start)	Pitch average (mm)			Length (mm)		
	Z1	Z2	Z3	Z1	Z2	Z3
2.5	0.432404662	0.648607	0.864809	19.98413	29.97619	39.96825
2.6875	0.357824997	0.536737	0.71565	16.47966	24.71949	32.95932
2.875	0.296277553	0.444416	0.592555	13.61236	20.41854	27.22472
3.0625	0.245412477	0.368119	0.490825	11.25679	16.88519	22.51359
3.25	0.203334476	0.305002	0.406669	9.316151	13.97423	18.6323
3.4375	0.168502117	0.252753	0.337004	7.714225	11.57134	15.42845
3.625	0.139654396	0.209482	0.279309	6.390118	9.585177	12.78024
3.8125	0.115755483	0.173633	0.231511	5.294634	7.941951	10.58927

Table 4: Strip lengths and related Pitches